

WHAT IS CLAIMED IS:

1. A cleaning apparatus comprising:

scrubbing means for scrubbing a surface of an object to be cleaned; and

ultrasonic wave projection means for supplying an aqueous cleaning agent against the surface of the object to be cleaned and generating an ultrasonic wave,

wherein said scrubbing means and said ultrasonic wave projection means are provided so as to oppose one another, and

the object to be cleaned is to be set between said scrubbing means and said ultrasonic wave projection means.

2. The cleaning apparatus as set forth in claim 1, further comprising:

cleaning agent supply means for supplying the aqueous cleaning agent onto the surface of the object to be cleaned on a side of said scrubbing means.

3. The cleaning apparatus as set forth in claim 1, further comprising:

transport means for transporting the object to be cleaned.

4. The cleaning apparatus as set forth in claim 1, wherein:

said scrubbing means is a cleaning brush.

5. The cleaning apparatus as set forth in claim 4, wherein:

said cleaning brush is a roll brush.

6. The cleaning apparatus as set forth in claim 4, wherein:

said cleaning brush is a disk brush. 6.36 NS

7. The cleaning apparatus as set forth in claim 1, wherein:

said ultrasonic wave projection means is an ultrasonic nozzle for blowing the cleaning agent and generating an ultrasonic wave.

8. The cleaning apparatus as set forth in claim 2, wherein:

said cleaning agent supply means is a spray for radially spraying the aqueous cleaning agent.

9. The cleaning apparatus as set forth in claim 1, wherein:

said ultrasonic wave is megasonic in a frequency

band within a range of from 850 kHz to 1 MHz.

10. The cleaning apparatus as set forth in claim 1, wherein:

said aqueous cleaning agent is pure water, superpure water, hydrogen water, ozone water, dilute hydrofluoric acid, or aqueous surface active agent.

Sub A 13 11. > The cleaning apparatus as set forth in claim 3, wherein:

wherein said transport means *is* transport rollers.

12. The cleaning apparatus as set forth in claim 3, wherein:

said transport means is a belt conveyer.

13. The cleaning apparatus as set forth in claim 1, further comprising:

a reverse mechanism for turning over the object to be cleaned.

14. The cleaning apparatus as set forth in claim 1, further comprising:

a rotation mechanism for rotating the object to be cleaned.

15. The cleaning apparatus as set forth in claim 14, wherein:

said rotation mechanism rotates the object to be cleaned about a rotation axis vertical to the abject while supporting it its peripheral portion.

16. A cleaning apparatus, comprising:

cleaning agent jet-spray means for jet-spraying an aqueous cleaning agent against a surface of an object to be cleaned under high pressure; and

ultrasonic wave projection means for supplying the cleaning agent to the surface of the object to be cleaned and generating an ultrasonic wave,

wherein said cleaning agent jet-spray means and said ultrasonic wave projection means are disposed so as to face one another, and

the object to be cleaned is to be set between said cleaning agent jet-spray means and said ultrasonic wave projection means.

17. The cleaning apparatus as set forth in claim 16, further comprising:

transport means for transporting the object to be cleaned.

16-26
134/147
P. Coe

18. The cleaning apparatus as set forth in claim 17, wherein:

said transport means is transport rollers.

19. The cleaning apparatus as set forth in claim 17, wherein:

said transport means is a belt conveyer.

20. The cleaning apparatus as set forth in claim 16, wherein:

said cleaning agent spray means is a high pressure spray nozzle.

21. The cleaning apparatus as set forth in claim 16, wherein:

said ultrasonic wave projection means is an ultrasonic nozzle for blowing the cleaning agent and generating an ultrasonic wave.

22. The cleaning apparatus as set forth in claim 16, wherein:

said ultrasonic wave is megasonic in a frequency band within a range of from 850 kHz to 1 MHz.

23. The cleaning apparatus as set forth in claim 16, wherein:

said aqueous cleaning agent is pure water, superpure water, hydrogen water, ozone water, dilute hydrofluoric acid, or aqueous surface active agent.

24. The cleaning apparatus as set forth in claim 16, further comprising:

a reverse mechanism for turning over the object to be cleaned.

25. The cleaning apparatus as set forth in claim 16, further comprising:

a rotation mechanism for rotating the object to be cleaned.

26. The cleaning apparatus as set forth in claim 25, wherein:

said rotation mechanism rotates the object to be cleaned about a rotation axis vertical to the abject while supporting it its peripheral portion.

27. A cleaning method, comprising the step of:
supplying an aqueous cleaning agent to a surface of an object to be cleaned; and

propagating ultrasonic to the object to be cleaned from its back surface, whereby the surface of the object to be cleaned is ultrasonically cleaned.

28. The cleaning method as set forth in claim 27, further comprising the step of:

scrubbing the surface of the object to be cleaned by scrubbing means,

wherein said scrubbing step and said ultrasonic cleaning step are performed simultaneously.

29. The cleaning method as set forth in claim 27, further comprising the step of:

transporting the object to be cleaned.

30. The cleaning method as set forth in claim 27, wherein:

said ultrasonic cleaning process is performed by applying the aqueous cleaning solution having applied thereto ultrasonic wave to a back surface of the object to be cleaned.

31. The cleaning method as set forth in claim 28, further composing the step of:

cleaning said scrubbing means by applying thereto an aqueous cleaning agent having applied thereto ultrasonic wave, said scrubbing means cleaning step being performed in a state where the object to be cleaned is not set.

32. The cleaning method as set forth in claim 28, wherein:

said scrubbing means is a cleaning brush.

33. A cleaning method, characterized by comprising the steps of:

transporting an object to be cleaned to be set between scrubbing means and ultrasonic wave projection means;

supplying an aqueous cleaning agent to a surface of the object to be cleaned on the side of said scrubbing means;

scrubbing the surface of the object to be cleaned by said scrubbing means;

ultrasonic-cleaning the surface of the object to be cleaned by applying the aqueous cleaning agent having applied thereto an ultrasonic wave by said ultrasonic wave projection means to its back surface and propagating ultrasonic wave to the object to be cleaned;

transporting said object to be cleaned out from a spacing between said scrubbing means and said ultrasonic cleaning means; and

cleaning said scrubbing means by applying thereto the aqueous cleaning agent having applied thereto the

ultrasonic wave by said ultrasonic wave projection means,

wherein said step of cleaning said scrubbing means is performed in a state where the object to be cleaned is not set.

34. The cleaning method as set forth in claim 33, wherein:

said step of scrubbing the surface of the object to be cleaned by said scrubbing means and said ultrasonic cleaning step are performed simultaneously.

35. The cleaning method as set forth in claim 33, wherein:

a plurality of said object to be cleaned are transported in and out successively.